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AFOSR-TR-87-1429 DAAG29-85-K-0043

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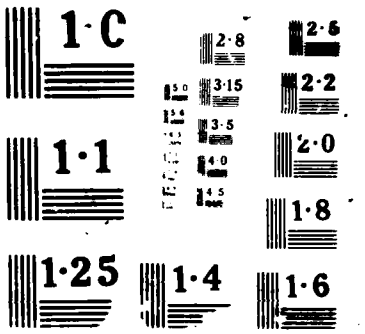
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19. ABSTRACT (Continue on reverse if necessary and identify by block number)

Instrumentation has been acquired and made operational for use in a study of the interaction of turbulence and combustion in premixed turbulent flames. This includes a laser Doppler anemometer for single point, two point and two component velocity measurements, a two-dimensional laser flow visualization system and a related data acquisition and processing microcomputer system.

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Julian M. Tishkoff	(202) 767-4935	AFOSR/NA

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I. Summary of Equipment Acquired

1.	Argon ion laser systems Mfg: Cooper Laser Sonics	$ 39,430
2.	LDV optical system Mfg: TSI, Intra Action Corporation, Pacific Inst., Newport Corp., CVI Laser, and other vendors	$ 29,567
3.	LDV counter processor electronics Mfg: TSI Inc.	$ 36,480
4.	Storage Oscilloscope System Mfg: Tektronix	$ 12,000
5.	Micro-Computer Data Acquisition and Processing System Mfg: IBM, Tecmar, Imaging Technology, and other vendors	$ 33,168
6.	2-D array camera system Mfg: EG&G Reticon	$ 3,730
	TOTAL	$154,375

The acquired equipment items 1, 2, 4 and 6 represent changes from the original equipment list.

Item 6, a Reticon array camera for use in 2-D flame structure measurements, was approved by Amendment A to AFOSR-85-0088.

The change in item 2 is a considerable cost reduction achieved through the use of standard optical components instead of the originally intended LDV optical system components manufactured by TSI. This resulted in an LDV optical system which is comparable in performance to a TSI system but considerably more flexible and less expensive.

Item 4 was originally intended to be a 50 MHz digital storage oscilloscope manufactured by Nicolet, however due to excessively long delivery times it was decided to purchase a comparable 100 MHz storage oscilloscope manufactured by Tektronix.

And lastly, item 1 reflects a significant increase in cost due to the fact that a second argon ion laser was purchased, primarily with funds made available by using standard optical components for the LDV optical system. This second laser together with spare LDV optics and the second LDV counter processor provide a second, complete LDV system for use in a number of research projects as described in the following section.

II. Summary of Research Projects

The equipment which has been acquired under AFOSR Grant 85-0088 has been used on an AFOSR sponsored project on premixed turbulent combustion (AFOSR-84-0224) and an ARO sponsored project on the effect of in-cylinder catalysts in low heat loss Diesel engines (DAAG29-85-K-0043), and will be used on a DOE sponsored project on dilute charge ignition. These three projects are briefly described below.

The Air Force Office of Scientific Research and NASA-Lewis are currently sponsoring a study of premixed turbulent combustion. In this project, the relationship between turbulence intensity and scales and turbulent flame structure is being studied using recently developed two-point LDV and two-dimensional flow visualization techniques. This research is addressing fundamental questions regarding the interaction of turbulence and combustion in premixed turbulent flames and will lead to improved phenomenological models for premixed turbulent flame propagation. The results from these experiments will also be used in detailed comparisons with results from a number of current attempts to numerical simulate premixed turbulent combustion.

The Army Research Office is currently supporting an experimental investigation of catalytical effects in low heat loss Diesel engines. This research is being conducted in a high pressure turbulent flow reactor under conditions similar to those that occur in an engine near TDC prior to ignition. The goals of this research are to determine the nature of catalytic effects under engine conditions and the operating conditions which are required for such effects to have a significant effect on engine combustion, particularly on preignition chemistry in terms of ignition delay and preferential oxidation of soot precursors. Since catalytic surface reactions are often diffusion limited, large free stream turbulence such as that found in an engine may significantly enhance the effect of the catalyst. Thus, detailed characterization of the flow field between the catalyst plates using LDV is essential in these experiments.

Effective July 1, 1986, the Department of Energy will be supporting a study of the role of turbulence on early flame kernel growth, particularly as it applies to the lean limit ignition characteristics of homogeneous charge, spark ignited engines. Again, LDV and 2-D flow visualization

techniques will be used to characterize ignition and early flame kernel growth and the effects of turbulence intensity and turbulence length scale on the lean ignition limit. Effects of free stream turbulence and of locally generated turbulence, e.g., due to flow around the spark plug or near the cylinder wall, will both be investigated.

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